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User's Manual
DITHERM

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1. General Information

The device lets you connect three independent thermocouples, galvanically isolated from each other and the power source, so the metal side of the thermocouples can make contact with metal surfaces that have a potential other than zero. You can use different types of thermocouples on the same module.

It is available in two versions, with CANBUS or RS485 MODBUS communication. A further RS232 connection via Jack is available to configure the device. You can set thresholds for alarms/warnings and the activation of relays, with the relevant response times for each temperature input.

1.1 VERSIONS AVAILABLE

E6102094000 xx	**DITHERM CANBUS** (isolated CAN BUS + non-isolated RS232 with jack connector). Designed to be used with devices DST4601/PX, GC3xx, GC5xx with CANBUS connection; up to 16 modules with proprietary protocol SICES EX-BUS can be connected, or one module and two thermocouples for reading exhaust gas on left and right banks with J1939 protocol.
E6102094001 xx	**DITHERM MODBUS RS485** (Isolated RS485 + non-isolated RS232 with jack connector used only for configuration). For use with devices using MODBUS RTU protocol with RS485 connection.

1.2 TECHNICAL DATA

Thermocouple Inputs					
	Type	**Min. temp.**	**Max. temp.**	**Reading resolution**	**Scale end error**
Thermocouples:	**B**	**50 °C (note 1)**	**1800 °C**	**0.5 °C**	**1.5 ‰**
	R	**0 °C**	**1400 °C**	**0.5 °C**	**1 ‰**
	S	**0 °C**	**1530 °C**	**0.5 °C**	**1 ‰**
	J	**0 °C**	**970 °C**	**0.5 °C**	**1 ‰**
	E	**0 °C**	**750 °C**	**0.5 °C**	**1 ‰**
	N	**0 °C**	**1300 °C**	**0.5 °C**	**1 ‰**
	K	**0 °C**	**1300 °C**	**0.5 °C**	**1 ‰**
	T	**0 °C**	**350 °C**	**0.5 °C**	**1 ‰**
Number of channels:	**3 galvanically isolated**				
Cold junction compensation:	from 0°C to 60°C				
Input impedance:	470 KΩ				
Sampling time:	300 ms				

⚠ ***NOTE 1: with type B thermocouples, due to their characteristics, with temperatures below 50°C, the reading will be 0°C in any case.***

⚠ **IMPORTANT: a double selection is required to set the type of thermocouple: the first by changing the software parameters, the second using switches SWA, SWB and SWC.**

⚠ WARNING: the voltage at the measurement inputs of the thermocouples must never be over 10VDC. Otherwise the device will be damaged and the corresponding reading will be wrong. Be careful not to connect the DC power supply instead of a thermocouple.

Power input	
Input voltage	7÷32VDC
Current absorbed	200 mA (@ 13V)
Consumption	Max. 2.4 W
Thermocouple input isolation	1000 V

Environmental conditions	
Operating temperature:	from -20°C to +60°C
Humidity:	from 30 to 90% condensate-free
Storage temperature:	from -20°C to +70°C
Degree of protection	IP 20

Dimensions/Weight			
Dimensions:	101Hx35Lx119D	**Weight:**	165 g

Connections
J1 VDC power supply
J4, **J6**, **J7** thermocouple inputs
JP 3.5 mm jack RS232 for parameter configuration.
J2 RS485 or CANBUS connection.
J5 cumulative alarms/prealarms/activations output (NO dry contact relay max. 30VDC @ 500mA)

1.3 INDICATORS

LED	*Meaning*
ON WORK	Device is powered; flashes to indicate device is functioning correctly
REMOTE	Indicates the state of the main communication interface. For can bus version: LED flashing = no communication (bus off or passive error), LED on = Can communication active (Active error). For RS485 version: LED off = no communication, LED on = communication active.
ALARM OUT	Indicates the state of relay output J5 (led ON = contact closed)
TEMP 1	Signals on temperature 1 (see table below)
TEMP 2	Signals on temperature 2 (see table below)
TEMP 3	Signals on temperature 3 (see table below)

TEMP1, 2, 3 LED flashing	Meaning
Off	No signal
one fast flashing	Indicates Delta T function has been activated, so temperature value T3 = T2-T1. Only on LED TEMP3.
two fast flashes	The relay output activation threshold has been reached.
50% alternate blinking	Exceeded high-temperature threshold (Prealarm).
Lit fixed	Exceeded max. temperature threshold (Alarm).

2. MODBUS SPECIFICATIONS

Protocol: **Rtu Modbus**

Two baud rates can be selected with switches: **9600 / 19200**

Transmission parameters: **N, 8, 1** fixed

Modbus address selectable with SWN switch: **1-32**

N.B.: register writing is protected (SWN-8=OFF → protection active, cannot write).

Modbus Registers - Input Register		Format
30001	Conv. points 1	16 bit with sign (range from -32768 to +32767)
30002	Conv. points 2	
30003	Conv. points 3	
30015	SWN switch on start-up and current	8 high bits = power on start-up, 8 low bits = current switch position. 0=OFF, 1=ON
30019	Test Flag	0 = normal operation, 1 = testing board
30031	Temperature of thermocouple 1	Offset = 0 (only positive values). Accuracy 0.5 ° C Temperature = register value / 2. (e.g.: 945 → 945/2 = 472.5°C) Temp. value Invalid = 17776 = 8888.0 °C
30032	Temperature of thermocouple 2	
30033	Temperature of thermocouple 3	
30061	Temperature 1 in Ex-Bus format	Ex-Bus format (16 bit): Offset = -273°C, 5 decimal bits (divide by 32) Valid values = 0x0000 - 0xFAFE (from -273 to 1734.94°C) 0xFFAFF = Overflow, 0x0000=Underflow 0xFF00 = unavailable, 0xFE01 = sensor disconnected
30062	Temperature 2 in Ex-Bus format	
30063	Temperature 3 in Ex-Bus format	
30101	Alarms and prealarms active for Temp.1	0=no signal 1=Alarm signal active 2=Prealarm signal active 3=signal. Alarm and prealarm active
30102	Alarms and prealarms active for Temp.2	
30103	Alarms and prealarms active for Temp.3	
30105	Relay State	0 = contact open, 1 = contact closed
30106	Relay activation (from activation threshold)	Bit 0 = 1 → activated by temp.1, bit 1 = 1 → activated by temp.2 Bit 2 = 1 → activated by temp.3

30201	Presence of CANBUS interface	1 = interface present, 0 = not present
30202	CANBUS state	0 = Error Active, 1 = Error Passive, 2 = BusOff
40001	Thermocouple type - conv. 1	0 = none, 1=B, 2=R, 3=S, 4=J, 5=E, 6=N, 7=K, 8=T
40002	Thermocouple type - conv. 2	
40003	Thermocouple type - conv. 3	
40101	High temperature threshold from temp. 1 (Prealarm)	Thresholds format: threshold value = register value / 2. Accuracy = 0.5 °C Offset = 0
40102	Maximum temperature threshold from temp. 1 (Alarm)	
40103	High temperature threshold from temp. 2 (Prealarm)	
40104	Maximum temperature threshold from temp. 2 (Alarm)	
40105	High temperature threshold from temp. 3 (Prealarm)	
40106	Maximum temperature threshold from temp. 3 (Alarm)	
40111	Enabling and time for temp.1 prealarm	0 = threshold disabled, > 0 = threshold enabled with response time shown in tenths of a second. (25 = 2.5 sec.)
40112	Enabling and time for temp.2 prealarm	
40113	Enabling and time for temp.3 prealarm	
40114	Enabling and time for temp.1 alarm	
40115	Enabling and time for temp.2 alarm	
40116	Enabling and time for temp.3 alarm	
40121	Relay enabling	0 = disabled, 1 = enabled on alarms, 2 = enabled on prealarms , 3 = enabled on alarms and prealarms.
40201	Relay activation threshold from temp.1	Thresholds format: threshold = (register value -700/10). Accuracy = 0.1 °C Offset = -70 °C
40202	Relay activation threshold from temp. 2	
40203	Relay activation threshold from temp. 3	
40206	Relay deactivation threshold from temp.1	
40207	Relay deactivation threshold from temp.2	
40208	Relay deactivation threshold from temp.3	
40221	Delta T function activation (Temp3 = Temp2 - Temp1)	0 = Off, 1 = On

3. CanBus specifications

Supported protocols: **EX-BUS, J1939**

Connection via standard J1939 or PMC bus owner

Not compatible with protocol-MTU MDEC

3.1 EX-BUS

CAN speed: **250 kbit/s**

CAN settings: **sample point at 75%, 11bit identifier (standard format)**

Messages transmitted EX-BUS:

ID	MIX	L. data	Description
0x410 – 0x41F	MXD-DITEMP	8 byte	**Temperatures**: 2 bytes for each measurement. Format: offset -273 °C, resolution 0.03125 °C/bit.
0x410 – 0x41F	MXS-DITEMP	6 byte	**Diagnostics**. Contains: board type, firmware revision, CAN error counters, alarm states.

Note: each module transmits with a single ID. The ID selection is made with SWN switches 1-4 (EX-BUS ADDRESS).

For further information on EX-BUS protocol, refer to EAAS0346xxxx specifications.

3.2 J1939

CAN speed: **250 kbit/s**

CAN settings: **sample point at 75%, 29-bit identifier (extended format)**

Messages sent to J1939:

PGN65031 – Exhaust Temperature (ET):

SPN 2433 - Exhaust gas temperature in right exhaust (Temperature 1)
SPN 2434 - Exhaust gas temperature in left exhaust (Temperature 2)

PGN60461 – DM1 Multipacket

Contains **PGN60160** (with signals of alarms for spn 2433 and spn 2434)

n.b.: J1939 temperature 3 input is not used.

4. Auxiliary Functions

4.1 Delta T

Implies only the use of thermocouples T1 and T2 (T3 is not connected); calculates the difference between temperatures T1 and T2 and uses the result in place of temperature T3 (therefore T3 = T2-T1).

TEMP3 Led flashes rapidly to indicate the function is activated and the temperature is estimated. The result of the difference is taken as a normal temperature, so it is transmitted instead of T3 and can be associated with thresholds. If T1 or T2 are invalid, T3 will also be invalid.

This function is activated by parameter. If the sensor connected to J3 is activated, it won't be detected.

4.2 Relay activation

The relay output is managed independently of alarms and prealarms through dedicated thresholds of activation and deactivation. Can be used to power fans or cooling systems. The thresholds are programmed in the parameters.

POSITIVE LOGIC: activation threshold > = deactivation threshold (e.g., activation threshold = 280 ° C, deactivation threshold = 240 ° C → the relay is normally open; when temp. reaches 280 °C, the relay is closed until the temp. drops below 240 °C).

NEGATIVE LOGIC: activation threshold < deactivation threshold (e.g. activation threshold = 350°C, deactivation threshold = 370°C → the relay remains closed as long as the temperature remains below 370°C. The relay opens when the temperature rises above 370°C and remains open until the temperature drops below 350°C)

5. Configuration

The DITHERM module is configured using the switches or parameters that can be set via serial port. To configure the type of thermocouple you should use both the switches and the parameter.

5.1 Switch settings

5.1.1 SWN switch functions for RS485 version

SWN SWITCHES	Description
1- 5	Assign modbus device address (from 1 to 32) with SW6 = ON
6	Modbus address block: ON = from switches 1-5, OFF=1 fixed
7	Not used
8	ON = enable parameter writing

Modbus address allocation table

MODBUS ADDRESS

SWN DIPSWITCHES	ON	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	5																	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	4									x	x	x	x	x	x	x	x									x	x	x	x	x	x	x	X
	3					x	x	x	x					x	x	x	x					x	x	x	x					x	x	x	X
	2			x	x			x	x			x	x			x	x			x	x			x	x			x	x			x	X
	1		x		x		x		x		x		x		x		x		x		x		x		x		x		x		x		X

5.1.2 SWN switches for CanBus Version

SWN SWITCHES	Description
1- 4	Assign modbus device address (from 1 to 16) and EX-BUS ID (from 0x410 to 0x41F)
5	CanBus protocol selection: OFF=EX-BUS, ON=J1939
6	Modbus address block: ON = address selected with switches 1-4, OFF = 1 fixed
7	Not used
8	ON = parameter writing enabled, OFF = parameter writing protected

SWN DIPSWITCHES	ON	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	4									x	x	x	x	x	x	x	x
	3					x	x	x	x					x	x	x	x
	2			x	x			x	x			x	x			x	x
	1		x		x		x		x		x		x		x		x

5.1.3 JP serial interface configuration switch

SWP SWITCH	ON	OFF
1	Insert the 120Ω termination resistor in RS485 line	Remove the 120Ω termination resistor from the RS485 line
2	Disable RS232/RS485 serial JP	Enable RS232/RS485 serial JP
3	Enable RS232 serial on JP	Enable RS485 serial on JP
4	Baud rate = 19200	Baud rate = 9600

5.1.4 Thermocouple type switch selection

SWA, SWB, SWC SWITCH	ON	OFF
1	B, S, R, T	J, E, K, N
2	Not used	Not used

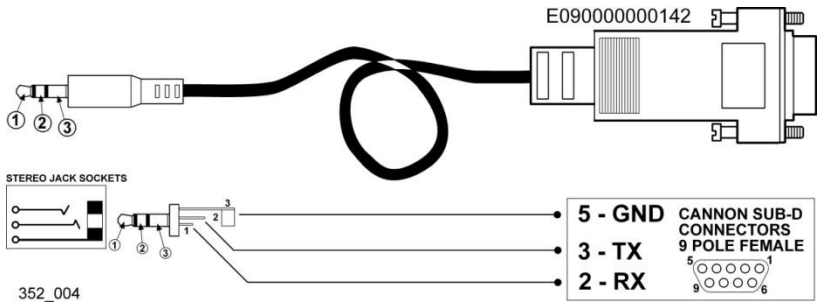
IMPORTANT: simply setting the switch is not enough to select the type of thermocouple, you must use the software configuration to modify the internal parameters (see following paragraph).

5.1.5 Configuration

The configuration requires connection to a PC via RS232 serial port using Jack connector **JP** or RS485 serial with connector **J2** and the BoardPrg program (version 2.25 and later).

BoardPrg can be downloaded from the site www.sices.biz in the software section → Sices Board Programming (select the latest version BoardPrg_x_yy_z.msi).

Notes: Use cable E090000000142 (RS232-E20931 module connection cable) to connect via a RS232 serial port (JP Jack connector).



- Set the serial port to be used on the PC (in **Communication Menu → Select Communication Resource**). Check the communication parameters: **9600, N, 8, 1**
- Set the **Modbus** address (in **Communication menu→ Serial address**: default = 1)
- Display the parameter window (in **File Menu →Parameter management**)
- Make the connection to the **DITHERM** board (**Connect**).

Important: Read the parameters (Read command), and transfer the values to the New Value column, where you can edit them (Copy command).

Now you can configure the device, and set:

- The type of thermocouple for the single inputs (**J4**, **J6**, **J7**).
- The alarm/prealarm thresholds, the method of activation of the relay output.
- Auxiliary functions configuration.

By default the alarms are disabled. To configure them use the second programming window in BoardPrg.

After configuration, check **SWE dipswitch 8 is ON** and press **Transmit**.

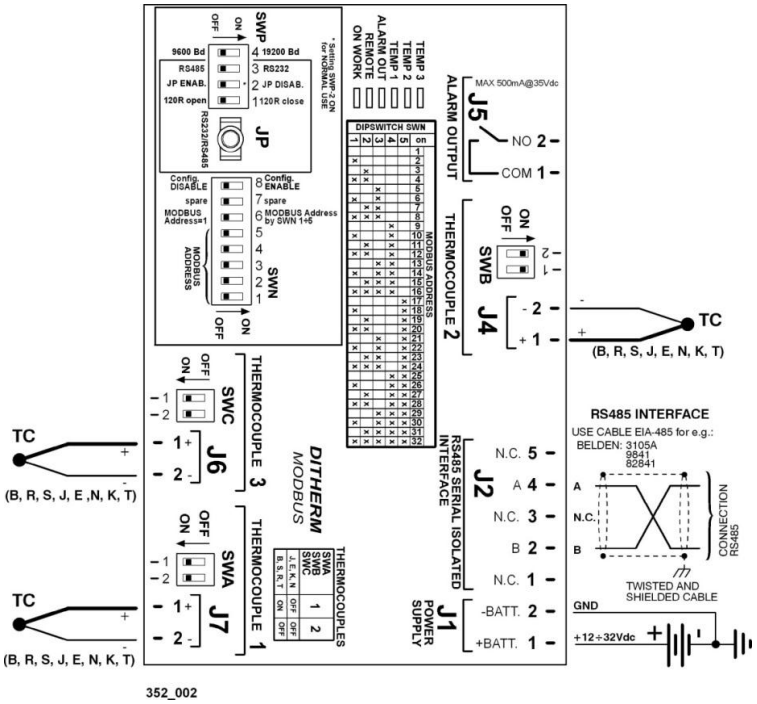
The configuration can be saved on a **PC** (Save), and reloaded (Load) at a later date to configure other modules in the same way.

After programming, switch SWE dipswitch 8 OFF again to activate write protection.

5.2 INSTALLATION INSTRUCTIONS

The device is designed to be mounted on a DIN 46277 guide in an upright position. It requires adequate ventilation to function properly. If possible, avoid installing above and/or near devices that produce heat.

Connections (RS485 version):

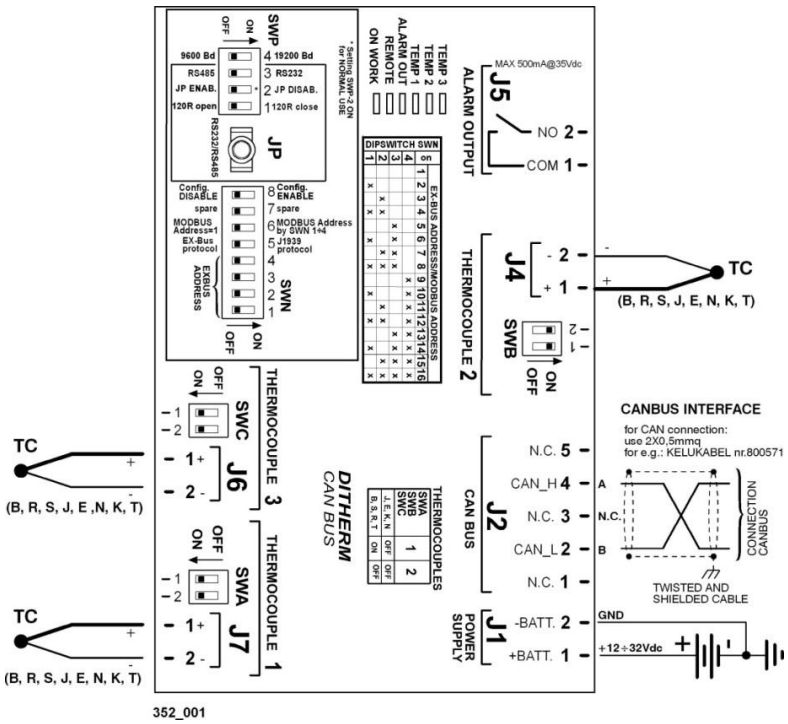


RS485/CANBUS terminations:

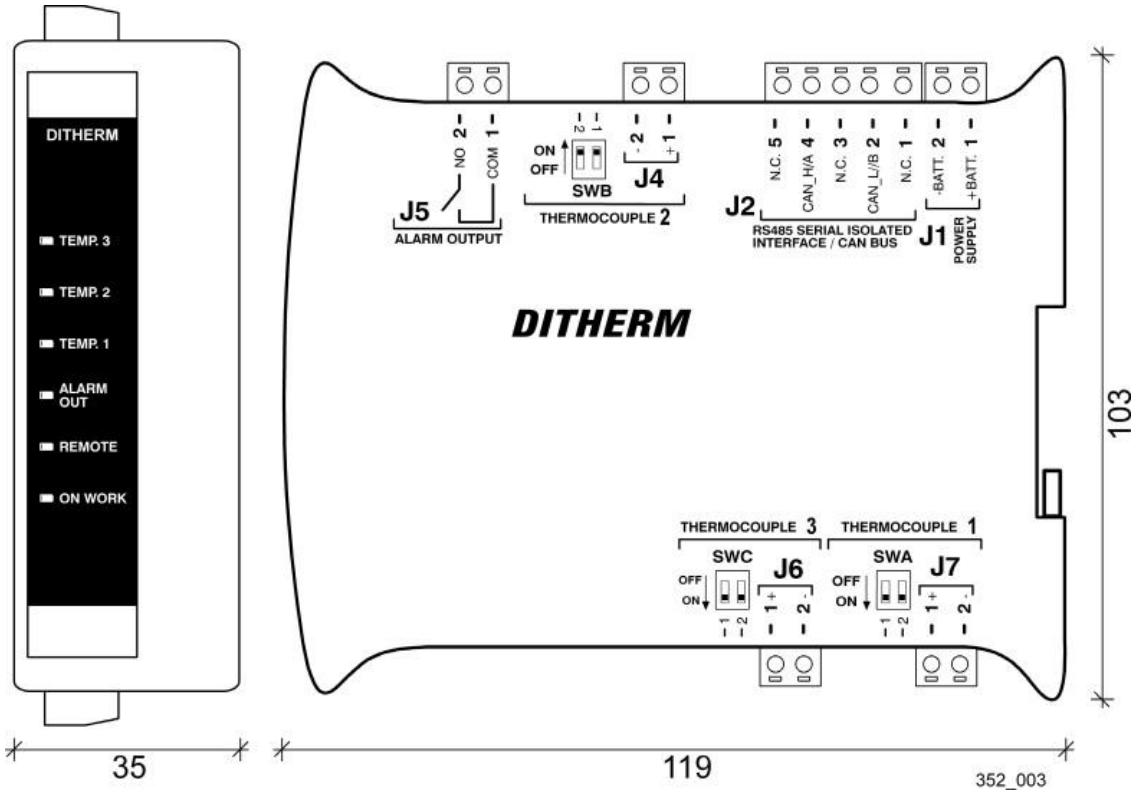
To minimize reflections, the first and last device in the BUS 485 network must have an **120 ohm ½ W** termination resistor connected in parallel with the line.

The same principle applies to the CANBUS network.

Connections (CAN BUS version):



Dimensions:


DITHERM
TEMP. 3
TEMP. 2
TEMP. 1
ALARM OUT
REMOTE
ON WORK
J5
ALARM OUTPUT
NO 2
COM 1
SWB
ON
OFF
J4
THERMOCOUPLE 2
J2
RS485 SERIAL ISOLATED INTERFACE / CAN BUS
N.C. 5
CAN_H/A 4
N.C. 3
CAN_L/B 2
N.C. 1
J1
POWER SUPPLY
-BATT. 2
+BATT. 1
DITHERM
THERMOCOUPLE 3
SWC
J6
THERMOCOUPLE 1
SWA
J7
OFF
ON
103
35
119
352_003

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